Citation:

Lutsey PL, Jacobs DR Jr, Kori S, Mayer-Davis E, Shea S, Steffen LM, Szklo M, Tracy R. Whole grain intake and its cross-sectional association with obesity, insulin resistance, inflammation, diabetes and subclinical CVD: The MESA Study.*Br J Nutr*. 2007 Aug;98(2):397-405.

PubMed ID: 17391554

Study Design:

Cross sectional study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

This study examined on the relationship between whole grain intake and selected CVD risk factors and measures of subclinical atherosclerosis using baseline data from the Multi-Ethnic Study of Atherosclerosis (MESA).

Inclusion Criteria:

Participants were chosen from MESA baseline data, between the ages of 45 and 84 years of age, free from clinical CVD, and from six US field centers.

Exclusion Criteria:

MESA participants were excluded if they had no diet data (N=577), implausible energy intakes (N=157), and had been previously diagnosed with diabetes (N=610).

Description of Study Protocol:

Recruitment Participants were chosen from MESA, a prospective epidemiological cohort study starting in July 2000 and reported elsewhere.

Design : cross-sectional study

Blinding NA

Intervention NA

Statistical Analysis

Mean levels of demographics, behaviors and physiological variables were provided by quintile of

whole grain intake.

Regression analyses were used to evaluate the association of each variable with whole grain intake.

Linear regression was used for continuous dependent variables, and logistic regression for dichotomous dependent variables.

Data Collection Summary:

Timing of Measurements Data came from the baseline data collection of MESA.

Dependent Variables

Factors related to coronary artery disease and diabetes:

- BMI, insulin, insulin resistance, newly diagnosed diabetes and impaired fasting glucose, CRP, IL-6, homocysteine, urine albumin excretion
- Carotid artery intima-media thickness and coronary artery calcification : imaging procedures

Independent Variables

- Servings per day of whole grains (whole grain breakfast cereal, oatmeal, dark bread, bran muffins, brown or wild rice) : participants completed a staff-assisted, self-administered 127-item food frequency questionnaire (FFQ), which was validated by correlation with intakes from eight 24-hr recalls. Whole grain intake was calculated in servings per day.

Control Variables

Description of Actual Data Sample:

Initial N: 5496 MESA participants

Attrition (final N): 5496

Age: 45-84 years

Ethnicity: non-Hispanic white, Hispanic, African American, and Chinese

Other relevant demographics: Race, age, sex, education level, smoking status, and physical actviity level.

Anthropometrics

Location: Data from six different US field centers which participated in MESA.

Summary of Results:

Key Findings

- Mean daily intake of whole-grain foods was 0.54 servings/day, ranging from 0.02 for the lowest quintile and 1.39 for the highest, all well below the recommended intake of 3 or more

servings. Less than 1% of the participants met this recommendation.
- Intake varied by race, with whites having the highest mean intake of 0.60 servings/day, blacks 0.53 servings/day, Hispanics 0.52 servings/day and Chinese 0.32 servings/day.
- Higher whole grain intake was strongly associated with race, being older, female, more educated, non-smoker, more leisure physical activity, lower sedentariness score, and with consuming more energy, fruits, vegetables, and dairy and less refined grains, meat and alcohol.
- Whole grain intake was not related to hormone replacement therapy, HDL or LDL cholesterol, systolic or diastolic blood pressures.
- Inverse associations were found between whole grain intake and BMI, insulin, insulin resistance, CRP, homocysteine and glucose.
- After adjustment for demographic and health behavior variables, mean differences for the highest quintile of whole grain intake (median servings/day: 1.39) minus the lowest quintile (median servings/day:0.02) of intake were 0.6 kg/m2 for BMI, 0.36 mg/l for C-reactive protein, 0.82 umol/l for homocysteine, 0.15 mU/l mmol/l for homeostasis model assessment (HOMA), 0.48 mU/l for serum insulin, 2.0 mg/dl for glucose, and 5.7% for prevalence of newly diagnosed impaired fasting glucose ($\geq$ 100 gm/dl or diabetes medication).
    - These differences represent 11-13% S.D. of BMI, HOMA, glucose and impaired fasting glucose, but 23%, 52% and 80% S.D. of homocysteine, C-reactive protein, and insulin, respectively.
- Whole grain intake was not associated with carotid artery intima-media thickness or presence of plaque.

Three models were developed for analysis: Model 1 (base demographics and energy intake), Model 2 (Model 1 plus smoking, alcohol, dietary intake and activity), Model 3 (Model 2 plus BMI and insulin).

CVD Risk Factor	Model	P trend
BMI	1,2	<0.0001
Insulin	1	<0.0001
	2	0.002
Insulin Resistance	1	<0.0001
	2	0.002
CRP	1	<0.0001
	2	0.004
Homocysteine	1,2,3	<0.0001
Glucose	1	0.001
	2	0.008

Other Findings

Author Conclusion:

Ethnic differences in whole grain intake were found, as well as strong cross-sectional associations

between whole grain consumption and healthful behavior, BMI, insulin, homocysteine, CRP and fasting glucose.

Failure to find associations between whole grain intake and subclinical markers may reflect the cross-sectional design. A cause-effect relationship cannot be inferred from these data and reverse causality may be an issue: it is possible that participants at greater risk for CVD may have begun taking behavior precautions to reduce their risk of a CVD event, such as increasing whole grain intake.

Reviewer Comments:

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes

2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A

5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes

	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes